



# SEQUENCE LISTING

<110> Dartois, Veronique A.  
Hoch, James A.  
Valle, Fernando  
Kumar, Manoj

<120> 2,5-DKG Permeases

<130> GC687-3-D1

<140> US 10/787,267

<141> 2004-02-25

<150> US 09/922,501

<151> 2001-08-03

<150> US 60/325,774

<151> 2000-08-04

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Met Asn Ser Ser Thr Asn Ala	
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acg aaa cgc tgg tgg tac atc atg cct atc gtg ttt atc acg tat agc	162
Thr Lys Arg Trp Trp Tyr Ile Met Pro Ile Val Phe Ile Thr Tyr Ser	
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ctg gcg tat ctc gac cgc gca aac ttc agc ttt gct tcg gca gcg ggc	210
Leu Ala Tyr Leu Asp Arg Ala Asn Phe Ser Phe Ala Ser Ala Ala Gly	
25 30 35	

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gca ctt ttc ttc ctc ggc tat ttc ttc ttc cag atc ccg ggg gcg att	306
Ala Leu Phe Phe Leu Gly Tyr Phe Phe Phe Gln Ile Pro Gly Ala Ile	
60 65 70	
tac gcg gaa cgc cgt agc gta cgg aag ctg att ttc atc tgt ctg atc	354
Tyr Ala Glu Arg Arg Ser Val Arg Lys Leu Ile Phe Ile Cys Leu Ile	
75 80 85	
ctg tgg ggc gcc tgc gcc tcg ctt gac cgg gat ggt gca caa tat tcc	402
Leu Trp Gly Ala Cys Ala Ser Leu Asp Arg Asp Gly Ala Gln Tyr Ser	
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agc gct ggc tgg cga tcc gtt tta ttc tcg gct gtc gtg gaa gcg gcg	450
Ser Ala Gly Trp Arg Ser Val Leu Phe Ser Ala Val Val Glu Ala Ala	
105 110 115	
gtc atg ccg gcg atg ctg att tac atc agt aac tgg ttt acc aaa tca	498
Val Met Pro Ala Met Leu Ile Tyr Ile Ser Asn Trp Phe Thr Lys Ser	
120 125 130 135	
gaa cgt tca cgc gcc aac acc ttc tta atc ctc ggc aac ccg gtc acg	546
Glu Arg Ser Arg Ala Asn Thr Phe Leu Ile Leu Gly Asn Pro Val Thr	
140 145 150	
gta ctg tgg atg tcg gtg gtc tcc ggc tac ctg att cag tcc ttc ggc	594
Val Leu Trp Met Ser Val Val Ser Gly Tyr Leu Ile Gln Ser Phe Gly	
155 160 165	
tgg cgt gaa atg ttt att att gaa ggc gtt ccg gcc gtc ctc tgg gcc	642
Trp Arg Glu Met Phe Ile Ile Glu Gly Val Pro Ala Val Leu Trp Ala	
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Phe Cys Trp Trp Val Leu Val Lys Val Lys Pro Ser Gln Val Asn Trp	
185 190 195	
ttg tcg gaa aac gag aaa gcc gcg ctg cag gcg cag ctg gag agc gag	738
Leu Ser Glu Asn Glu Lys Ala Ala Leu Gln Ala Gln Leu Glu Ser Glu	
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cag cag ggt att aaa gcc gtg cgt aac tac ggc gaa gcc ttc cgc tca	786
Gln Gln Gly Ile Lys Ala Val Arg Asn Tyr Gly Glu Ala Phe Arg Ser	
220 225 230	
cgc aac gtc att cta ctg tgc atg cag tat ttt gcc tgg agt atc ggc	834
Arg Asn Val Ile Leu Leu Cys Met Gln Tyr Phe Ala Trp Ser Ile Gly	
235 240 245	
gtg tac ggt ttt gtg ctg tgg ttg ccg tca att att cgc agc ggc ggc	882
Val Tyr Gly Phe Val Leu Trp Leu Pro Ser Ile Ile Arg Ser Gly Gly	
250 255 260	

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Val Asn Met Gly Met Val Glu Val Gly Trp Leu Ser Ser Val Pro Tyr	
265 270 275	
ctg gcc gcg act att gcg atg atc gtc gtc tcc tgg gct tcc gat aaa	978
Leu Ala Ala Thr Ile Ala Met Ile Val Val Ser Trp Ala Ser Asp Lys	
280 285 290 295	
atg cag aac cgt aaa ctg ttc gtc tgg ccg ctg ctg ctg att ggc gga	1026
Met Gln Asn Arg Lys Leu Phe Val Trp Pro Leu Leu Leu Ile Gly Gly	
300 305 310	
ctg gct ttt att ggc tca tgg gcc gtc ggc gct aac cat ttc tgg gcc	1074
Leu Ala Phe Ile Gly Ser Trp Ala Val Gly Ala Asn His Phe Trp Ala	
315 320 325	
tct tat acc ctg ctg gtg att gcc aat gcg gca atg tac gcc cct tac	1122
Ser Tyr Thr Leu Leu Val Ile Ala Asn Ala Ala Met Tyr Ala Pro Tyr	
330 335 340	
ggg ccg ttt ttc gcc atc att ccg gaa atg ctg ccg cgt aac gtc gcc	1170
Gly Pro Phe Phe Ala Ile Ile Pro Glu Met Leu Pro Arg Asn Val Ala	
345 350 355	
ggg ggc gca atg gcg ctc atc aac agc atg ggg gcc tta ggt tca ttc	1218
Gly Gly Ala Met Ala Leu Ile Asn Ser Met Gly Ala Leu Gly Ser Phe	
360 365 370 375	
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Phe Gly Ser Trp Phe Val Gly Tyr Leu Asn Gly Thr Thr Gly Ser Pro	
380 385 390	
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Ser Ala Ser Tyr Ile Phe Met Gly Val Ala Leu Phe Ala Ser Val Trp	
395 400 405	
ctt act tta att gtt aag cct gct aac aat caa aag ctc ccc atc ggc	1362
Leu Thr Leu Ile Val Lys Pro Ala Asn Asn Gln Lys Leu Pro Ile Gly	
410 415 420	
gct cgt cac gcc tgacctttac tactttacgga gatcacgcct tgggtacgtt	1414
Ala Arg His Ala	
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	35	40	45
Gly Ile Ser	Ser Leu Leu Gly Ala Leu	Phe Phe Leu Gly Tyr Phe	Phe
	50	55	60
Phe Gln Ile	Pro Gly Ala Ile Tyr Ala	Glu Arg Arg Ser Val Arg	Lys
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Leu Ile Phe	Ile Cys Leu Ile Leu Trp	Gly Ala Cys Ala Ser Leu	Asp
	85	90	95
Arg Asp Gly	Ala Gln Tyr Ser Ser Ala	Gly Trp Arg Ser Val Leu	Phe
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Ser Ala Val	Val Glu Ala Ala Val Met	Pro Ala Met Leu Ile Tyr	Ile
	115	120	125
Ser Asn Trp	Phe Thr Lys Ser Glu Arg	Ser Arg Ala Asn Thr Phe	Leu
	130	135	140
Ile Leu Gly	Asn Pro Val Thr Val Leu	Trp Met Ser Val Val Ser	Gly
145		150	155
Tyr Leu Ile	Gln Ser Phe Gly Trp Arg	Glu Met Phe Ile Ile Glu	Gly
	165	170	175
Val Pro Ala	Val Leu Trp Ala Phe Cys	Trp Trp Val Leu Val Lys	Val
	180	185	190
Lys Pro Ser	Gln Val Asn Trp Leu Ser	Glu Asn Glu Lys Ala Ala	Leu
	195	200	205
Gln Ala Gln	Leu Glu Ser Glu Gln Gln	Gly Ile Lys Ala Val Arg	Asn
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Tyr Gly Glu	Ala Phe Arg Ser Arg Asn	Val Ile Leu Leu Cys Met	Gln
225		230	235
Tyr Phe Ala	Trp Ser Ile Gly Val Tyr	Gly Phe Val Leu Trp Leu	Pro
	245	250	255
Ser Ile Ile	Arg Ser Gly Gly Val Asn	Met Gly Met Val Glu Val	Gly
	260	265	270
Trp Leu Ser	Ser Val Pro Tyr Leu Ala	Ala Thr Ile Ala Met Ile	Val
	275	280	285
Val Ser Trp	Ala Ser Asp Lys Met Gln	Asn Arg Lys Leu Phe Val	Trp
	290	295	300
Pro Leu Leu	Leu Ile Gly Gly Leu Ala	Phe Ile Gly Ser Trp Ala	Val
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Gly Ala Asn	His Phe Trp Ala Ser Tyr	Thr Leu Leu Val Ile Ala	Asn
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Ala Ala Met	Tyr Ala Pro Tyr Gly Pro	Phe Phe Ala Ile Ile Pro	Glu
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Met Leu Pro	Arg Asn Val Ala Gly Gly	Ala Met Ala Leu Ile Asn	Ser
	355	360	365
Met Gly Ala	Leu Gly Ser Phe Gly Ser	Trp Phe Val Gly Tyr Leu	
	370	375	380
Asn Gly Thr	Thr Gly Ser Pro Ser Ala	Ser Tyr Ile Phe Met Gly	Val
385		390	395
Ala Leu Phe	Ala Ser Val Trp Leu Thr	Leu Ile Val Lys Pro Ala	Asn
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aacaccgagt ttataaccct gaacgacacg gctgcgggcc tgtgtagacg cccctacgcc     180
ttaacaccac taaatgactc tacaggtgta tat atg aat aca gcc tct gtt tct     234
                               Met Asn Thr Ala Ser Val Ser
                               1               5

gtc acc caa agc cag gcg atc ccc aaa tta cgc tgg ttg aga ata gtg      282
Val Thr Gln Ser Gln Ala Ile Pro Lys Leu Arg Trp Leu Arg Ile Val
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ccg cct att ctt att acc tgc att att tcc tat atg gac cgg gtg aac      330
Pro Pro Ile Leu Ile Thr Cys Ile Ile Ser Tyr Met Asp Arg Val Asn
              25                30                35

atc gcc ttc gcc atg ccc ggc ggc atg gac gat gaa ctg ggc atc acc      378
Ile Ala Phe Ala Met Pro Gly Gly Met Asp Asp Glu Leu Gly Ile Thr
              40                45                50                55

gcc tcg atg gcc ggg ttg gcc ggc ggt att ttc ttt atc ggt tat ctg      426
Ala Ser Met Ala Gly Leu Ala Gly Gly Ile Phe Phe Ile Gly Tyr Leu
              60                65                70

ttc ttg cag gta ccc ggc ggc aag ctg gcg gtg tac ggc aac ggc aag      474
Phe Leu Gln Val Pro Gly Gly Lys Leu Ala Val Tyr Gly Asn Gly Lys
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aaa ttc atc ggt tgg tcg ttg ttg gcc tgg gcg gtg att tcc gtg ctg      522
Lys Phe Ile Gly Trp Ser Leu Leu Ala Trp Ala Val Ile Ser Val Leu
              90                95                100

acc ggg ctg gtc acg aat cag tat caa ttg ctg ttc ctg cgc ttc gcc      570
Thr Gly Leu Val Thr Asn Gln Tyr Gln Leu Leu Phe Leu Arg Phe Ala
              105                110                115

ctc ggc cgt ttc cga agc ggc atg ctg cgg tgg gtg ctg acc atg atc      618
Leu Gly Arg Phe Arg Ser Gly Met Leu Arg Trp Val Leu Thr Met Ile
              120                125                130                135

agc aac tgg ttc ccg gac aag gaa cgc ggg cgc gcc aac gcc atc gtc      666
Ser Asn Trp Phe Pro Asp Lys Glu Arg Gly Arg Ala Asn Ala Ile Val
              140                145                150

atc atg ttc gtg ccg atc gcc ggc atc ctt acc gca ccg ctg tcc ggc      714
Ile Met Phe Val Pro Ile Ala Gly Ile Leu Thr Ala Pro Leu Ser Gly
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Ala Leu Ser Leu Val Val Met Val Leu Trp Tyr Phe Thr Ile Ser Asn	
185 190 195	
cgt cca caa gag gcc aaa agg att tcg cag gcg gaa aaa gat tat ctg	858
Arg Pro Gln Glu Ala Lys Arg Ile Ser Gln Ala Glu Lys Asp Tyr Leu	
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atc aaa acg ctg cac gac gaa cag ttg ctg atc aaa ggc aaa acg gtg	906
Ile Lys Thr Leu His Asp Glu Gln Leu Leu Ile Lys Gly Lys Thr Val	
220 225 230	
cgc aac gcc tgc ctg cgt cgg gtg ctg ggc gac aaa atc atg tgg aag	954
Arg Asn Ala Ser Leu Arg Arg Val Leu Gly Asp Lys Ile Met Trp Lys	
235 240 245	
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Phe Phe Tyr Gln Thr Gly Ile Tyr Gly Tyr Thr Leu Trp Leu Pro Thr	
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Ile Leu Lys Gly Leu Thr Asn Gly Asn Met Glu Gln Val Gly Met Leu	
265 270 275	
gct atc ctg ccc tat atc ggc gcc atc ttc ggc atg ctg atc att tcc	1098
Ala Ile Leu Pro Tyr Ile Gly Ala Ile Phe Gly Met Leu Ile Ile Ser	
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Thr Leu Ser Asp Arg Thr Gly Lys Arg Lys Val Phe Val Ala Leu Pro	
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Leu Ala Cys Phe Ala Ile Cys Met Ala Leu Ser Val Leu Leu Lys Asp	
315 320 325	
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His Ile Trp Trp Ser Tyr Ala Ala Leu Val Gly Cys Gly Val Phe Thr	
330 335 340	
cag gcc gcc gcc ggg gtg ttc tgg acc att ccg ccc aag ctg ttt aac	1290
Gln Ala Ala Ala Gly Val Phe Trp Thr Ile Pro Pro Lys Leu Phe Asn	
345 350 355	
gcc gaa atg gcc ggc ggc gcg cgc ggc gtg atc aat gca ctg ggc aac	1338
Ala Glu Met Ala Gly Gly Ala Arg Gly Val Ile Asn Ala Leu Gly Asn	
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Leu Gly Gly Phe Cys Gly Pro Tyr Met Val Gly Val Leu Ile Thr Leu	
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Phe Ser Lys Asp Val Gly Val Tyr Ser Leu Ala Val Ser Leu Ala Ser	
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Gly Ala Glu	
425	

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Ala Val Tyr Gly Asn Gly Lys Lys Phe Ile Gly Trp Ser Leu Leu Ala	
85 90 95	
Trp Ala Val Ile Ser Val Leu Thr Gly Leu Val Thr Asn Gln Tyr Gln	
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130 135 140	
Gly Arg Ala Asn Ala Ile Val Ile Met Phe Val Pro Ile Ala Gly Ile	
145 150 155 160	
Leu Thr Ala Pro Leu Ser Gly Trp Ile Ile Thr Ala Trp Asp Trp Arg	
165 170 175	
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180 185 190	
Trp Tyr Phe Thr Ile Ser Asn Arg Pro Gln Glu Ala Lys Arg Ile Ser	
195 200 205	
Gln Ala Glu Lys Asp Tyr Leu Ile Lys Thr Leu His Asp Glu Gln Leu	
210 215 220	
Leu Ile Lys Gly Lys Thr Val Arg Asn Ala Ser Leu Arg Arg Val Leu	

225		230		235		240									
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Met	Glu	Gln	Val	Gly	Met	Leu	Ala	Ile	Leu	Pro	Tyr	Ile	Gly	Ala	Ile
		275		280		285									
Phe	Gly	Met	Leu	Ile	Ile	Ser	Thr	Leu	Ser	Asp	Arg	Thr	Gly	Lys	Arg
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305				310		315									
Leu	Ser	Val	Leu	Leu	Lys	Asp	His	Ile	Trp	Trp	Ser	Tyr	Ala	Ala	Leu
				325		330									
Val	Gly	Cys	Gly	Val	Phe	Thr	Gln	Ala	Ala	Ala	Gly	Val	Phe	Trp	Thr
				340		345									
Ile	Pro	Pro	Lys	Leu	Phe	Asn	Ala	Glu	Met	Ala	Gly	Gly	Ala	Arg	Gly
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Ile Met Pro Ile Val Phe Ile Thr Tyr Ser Leu Ala Tyr Leu Asp Arg	
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Ala Asn Phe Ser Phe Ala Ser Ala Ala Gly Ile Thr Glu Asp Leu Gly	
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Tyr Phe Phe Phe Gln Ile Pro Gly Ala Ile Tyr Ala Glu Arg Arg Ser	
65 70 75	



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Val Arg Lys Leu Ile Phe Ile Cys Leu Ile Leu Trp Gly Ala Cys Ala 80 85 90	
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Ser Leu Asp Arg Asp Gly Ala Gln Tyr Ser Arg Ala Gly Arg Ala Ile 95 100 105	
cgc ttt atc ctt ggc gtg gtc gag gcc gca gtc atg ccg gcg atg ctg	447
Arg Phe Ile Leu Gly Val Val Glu Ala Ala Val Met Pro Ala Met Leu 110 115 120 125	
ata tac atc agc aac tgg ttt acc aaa tcc gaa cgc tcg cgc gcc aat	495
Ile Tyr Ile Ser Asn Trp Phe Thr Lys Ser Glu Arg Ser Arg Ala Asn 130 135 140	
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Thr Phe Leu Ile Leu Gly Asn Pro Val Thr Val Leu Trp Met Ser Val 145 150 155	
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Val Ser Gly Tyr Leu Ile Gln Ala Phe Gly Trp Arg Glu Met Phe Ile 160 165 170	
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Ile Glu Gly Val Pro Ala Val Ile Trp Ala Phe Cys Trp Trp Val Leu 175 180 185	
gta aaa gat aaa ccg tct cag gtc aac tgg ctg gcg gaa agc gaa aag	687
Val Lys Asp Lys Pro Ser Gln Val Asn Trp Leu Ala Glu Ser Glu Lys 190 195 200 205	
gcc gca ttg cag gag cag ctg gag cgc gaa cag cag ggt atc aaa ccg	735
Ala Ala Leu Gln Glu Gln Leu Glu Arg Glu Gln Gln Gly Ile Lys Pro 210 215 220	
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Val Arg Asn Tyr Gly Glu Ala Phe Arg Ser Arg Asn Val Val Leu Leu 225 230 235	
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Cys Met Gln Tyr Phe Ala Trp Ser Ile Gly Val Tyr Gly Phe Val Leu 240 245 250	
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Trp Leu Pro Ser Ile Ile Arg Ser Gly Gly Glu Asn Met Gly Met Val 255 260 265	
gag gtc ggc tgg ctc tca tcc gtc ccc tac ctg gcg gca acc atc gcc	927
Glu Val Gly Trp Leu Ser Ser Val Pro Tyr Leu Ala Ala Thr Ile Ala 270 275 280 285	
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Phe Val Trp Pro Leu Leu Leu Ile Ala Ala Phe Ala Phe Ile Gly Ser	
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tgg gcc gtc ggc gct aac cat ttc tgg gtc tct tat acc ctg ctg gtc	1071
Trp Ala Val Gly Ala Asn His Phe Trp Val Ser Tyr Thr Leu Leu Val	
320 325 330	
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Ile Ala Gly Ala Ala Met Tyr Ala Pro Tyr Gly Pro Phe Phe Ala Ile	
335 340 345	
att ccc gag atg ctg ccg cgt aac gtc gcc ggg ggc gcc atg gcg ctg	1167
Ile Pro Glu Met Leu Pro Arg Asn Val Ala Gly Gly Ala Met Ala Leu	
350 355 360 365	
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Ile Asn Ser Met Gly Ala Leu Gly Ser Phe Phe Gly Ser Trp Phe Val	
370 375 380	
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Gly Tyr Leu Asn Gly Thr Thr Gly Ser Pro Ser Ala Ser Tyr Ile Phe	
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Met Gly Val Ala Leu Phe Val Ser Val Trp Leu Thr Leu Ile Val Lys	
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cct gct aat aat caa aaa ctt ccg ctc ggc gca cgt cac gcc	1353
Pro Ala Asn Asn Gln Lys Leu Pro Leu Gly Ala Arg His Ala	
415 420 425	
tgaaacatta acgcaacgga gaaccgcatg aagccgctcag tcattctcta caaaacgctt	1413
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<211> 427

<212> PRT

<213> Klebsiella oxytoca

<400> 6

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Ser Phe Ala Ser Ala Ala Gly Ile Thr Glu Asp Leu Gly Ile Thr Lys	
35 40 45	
Gly Ile Ser Ser Leu Leu Gly Ala Leu Phe Phe Leu Gly Tyr Phe Phe	
50 55 60	
Phe Gln Ile Pro Gly Ala Ile Tyr Ala Glu Arg Arg Ser Val Arg Lys	
65 70 75 80	
Leu Ile Phe Ile Cys Leu Ile Leu Trp Gly Ala Cys Ala Ser Leu Asp	
85 90 95	
Arg Asp Gly Ala Gln Tyr Ser Arg Ala Gly Arg Ala Ile Arg Phe Ile	
100 105 110	

Leu Gly Val Val Glu Ala Ala Val Met Pro Ala Met Leu Ile Tyr Ile  
 115 120 125  
 Ser Asn Trp Phe Thr Lys Ser Glu Arg Ser Arg Ala Asn Thr Phe Leu  
 130 135 140  
 Ile Leu Gly Asn Pro Val Thr Val Leu Trp Met Ser Val Val Ser Gly  
 145 150 155 160  
 Tyr Leu Ile Gln Ala Phe Gly Trp Arg Glu Met Phe Ile Ile Glu Gly  
 165 170 175  
 Val Pro Ala Val Ile Trp Ala Phe Cys Trp Trp Val Leu Val Lys Asp  
 180 185 190  
 Lys Pro Ser Gln Val Asn Trp Leu Ala Glu Ser Glu Lys Ala Ala Leu  
 195 200 205  
 Gln Glu Gln Leu Glu Arg Glu Gln Gln Gly Ile Lys Pro Val Arg Asn  
 210 215 220  
 Tyr Gly Glu Ala Phe Arg Ser Arg Asn Val Val Leu Leu Cys Met Gln  
 225 230 235 240

Tyr Phe Ala Trp Ser Ile Gly Val Tyr Gly Phe Val Leu Trp Leu Pro  
 245 250 255  
 Ser Ile Ile Arg Ser Gly Gly Glu Asn Met Gly Met Val Glu Val Gly  
 260 265 270  
 Trp Leu Ser Ser Val Pro Tyr Leu Ala Ala Thr Ile Ala Met Ile Val  
 275 280 285  
 Val Ser Trp Ala Ser Asp Lys Met Gln Asn Arg Lys Leu Phe Val Trp  
 290 295 300  
 Pro Leu Leu Leu Ile Ala Ala Phe Ala Phe Ile Gly Ser Trp Ala Val  
 305 310 315 320  
 Gly Ala Asn His Phe Trp Val Ser Tyr Thr Leu Leu Val Ile Ala Gly  
 325 330 335  
 Ala Ala Met Tyr Ala Pro Tyr Gly Pro Phe Phe Ala Ile Ile Pro Glu  
 340 345 350  
 Met Leu Pro Arg Asn Val Ala Gly Gly Ala Met Ala Leu Ile Asn Ser  
 355 360 365  
 Met Gly Ala Leu Gly Ser Phe Phe Gly Ser Trp Phe Val Gly Tyr Leu  
 370 375 380  
 Asn Gly Thr Thr Gly Ser Pro Ser Ala Ser Tyr Ile Phe Met Gly Val  
 385 390 395 400  
 Ala Leu Phe Val Ser Val Trp Leu Thr Leu Ile Val Lys Pro Ala Asn  
 405 410 415  
 Asn Gln Lys Leu Pro Leu Gly Ala Arg His Ala  
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<211> 1600

<212> DNA

<213> Pantoea citrea

<220>

<221> CDS

<222> (214)...(1521)

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tttatagctc ctgataagca cagttcgcag cgcgtaactg caccgcgagg gttctgcttt	180
gcgtcaactg acaaaacaga aaggggatat atc atg caa aaa tca cag ccg gga	234

	Met	Gln	Lys	Ser	Gln	Pro	Gly	
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acc cgc tgg ttt cgg att att gtg ccg atc ctg ata gcc tgc atc atg								282
Thr Arg Trp Phe Arg Ile Ile Val Pro Ile Leu Ile Ala Cys Ile Met								
	10				15		20	
tcg ttt atg gat cgg gta aat atc agt ttc gca ttg ccg ggc ggt atg								330
Ser Phe Met Asp Arg Val Asn Ile Ser Phe Ala Leu Pro Gly Gly Met								
	25				30		35	
gag cag gat ctg ctg atg tcc agc cag atg gcc ggg gta gtt agc ggt								378
Glu Gln Asp Leu Leu Met Ser Ser Gln Met Ala Gly Val Val Ser Gly								
	40				45		50	55
att ttc ttt att ggt tat ctg ttt ttg cag gtt cct ggt ggg cat atc								426
Ile Phe Phe Ile Gly Tyr Leu Phe Leu Gln Val Pro Gly Gly His Ile								
				60			65	70
gca gta cgt ggc agt ggt aaa cgt ttt att gcc tgg tcg ctt gtt gcc								474
Ala Val Arg Gly Ser Gly Lys Arg Phe Ile Ala Trp Ser Leu Val Ala								
				75			80	85
tgg gcc gtt gtt tct gtc gct acc ggg ttt gtg act cat cag tac cag								522
Trp Ala Val Val Ser Val Ala Thr Gly Phe Val Thr His Gln Tyr Gln								
				90			95	100
ctg ttg att tta cgt ttt gca ctg ggg gtc tct gaa ggt ggg atg ttg								570
Leu Leu Ile Leu Arg Phe Ala Leu Gly Val Ser Glu Gly Gly Met Leu								
	105				110		115	
ccg gta gtt ctg aca atg gtc agc aac tgg ttt cct gaa aaa gag ctg								618
Pro Val Val Leu Thr Met Val Ser Asn Trp Phe Pro Glu Lys Glu Leu								
	120				125		130	135
ggg cgt gct aat gca ttt gtc atg atg ttc gcc ccg ctt ggc gga atg								666
Gly Arg Ala Asn Ala Phe Val Met Met Phe Ala Pro Leu Gly Gly Met								
				140			145	150
att acc gcc cct gtc tcc gga tgg att att gca ctg cta gac tgg cgc								714
Ile Thr Ala Pro Val Ser Gly Trp Ile Ile Ala Leu Leu Asp Trp Arg								
				155			160	165
tgg tta ttt att atc gaa gga tta ctg tcg gta gtg gtt ctg gca gtc								762
Trp Leu Phe Ile Ile Glu Gly Leu Leu Ser Val Val Val Leu Ala Val								
	170				175		180	
tgg tgg ctg atg gtc agt gac cgc cct gaa gat gcc cgt tgg ctg ccg								810
Trp Trp Leu Met Val Ser Asp Arg Pro Glu Asp Ala Arg Trp Leu Pro								
	185				190		195	
gca gca gaa cgg gaa tat ctg ctg cgc gaa atg gcc cgt gac aag gcc								858
Ala Ala Glu Arg Glu Tyr Leu Leu Arg Glu Met Ala Arg Asp Lys Ala								
	200				205		210	215
gag cgg agc aaa ctc cct ccg atc agt cat gct ccc ctg caa gag gtt								906
Glu Arg Ser Lys Leu Pro Pro Ile Ser His Ala Pro Leu Gln Glu Val								

220	225	230	
ttc cat aac ccg ggc ctg atg aag tta gtg att ctg aac ttt ttc tat			954
Phe His Asn Pro Gly Leu Met Lys Leu Val Ile Leu Asn Phe Phe Tyr			
235	240	245	
cag aca ggt gat tac gga tac act ctg tgg ctg ccg act att atc aaa			1002
Gln Thr Gly Asp Tyr Gly Tyr Thr Leu Trp Leu Pro Thr Ile Ile Lys			
250	255	260	
aac ctg acc gga gct agt att ggt aac gtc ggt ttg ctg aca gtg cta			1050
Asn Leu Thr Gly Ala Ser Ile Gly Asn Val Gly Leu Leu Thr Val Leu			
265	270	275	
cct ttt atc gcg acg tta tca ggg att tat gtc gtc tct tac ctg agc			1098
Pro Phe Ile Ala Thr Leu Ser Gly Ile Tyr Val Val Ser Tyr Leu Ser			
280	285	290	295
gat aaa acc ggc aaa cgt cgg caa tgg gtg atg att tct ctg ttc tgt			1146
Asp Lys Thr Gly Lys Arg Arg Gln Trp Val Met Ile Ser Leu Phe Cys			
300	305	310	
ttt gcg gcc tgc ctg ttg gcc tca gtc ctg tta cgt gaa ttt gtg ctg			1194
Phe Ala Ala Cys Leu Leu Ala Ser Val Leu Leu Arg Glu Phe Val Leu			
315	320	325	
gct gct tat ctg gct ctg gtg gct tgc ggc ttt ttc ctg aaa gca gcc			1242
Ala Ala Tyr Leu Ala Leu Val Ala Cys Gly Phe Phe Leu Lys Ala Ala			
330	335	340	
acc agc ccg ttc tgg agt att ccg gga cgt att gca ccg ccg gaa gca			1290
Thr Ser Pro Phe Trp Ser Ile Pro Gly Arg Ile Ala Pro Pro Glu Ala			
345	350	355	
gcc ggt agt gcc cgt ggt gta att aac gga ctg ggg aat ctg ggc ggt			1338
Ala Gly Ser Ala Arg Gly Val Ile Asn Gly Leu Gly Asn Leu Gly Gly			
360	365	370	375
ttc tgc ggc ccc tgg ctg gtc gga tta atg atc tac ctg tac gga cag			1386
Phe Cys Gly Pro Trp Leu Val Gly Leu Met Ile Tyr Leu Tyr Gly Gln			
380	385	390	
aat gca gcc gtt gtt act ctg gca ggc tct ctg atc att gcc ggg att			1434
Asn Ala Ala Val Val Thr Leu Ala Gly Ser Leu Ile Ile Ala Gly Ile			
395	400	405	
att gcg gca tta ctg cca acg cag tgt gat ctg cgc ccg gca gag gca			1482
Ile Ala Ala Leu Leu Pro Thr Gln Cys Asp Leu Arg Pro Ala Glu Ala			
410	415	420	
cgg cag cag aat ttc acc cca cgt att cat gat gcc aaa taatactgtc			1531
Arg Gln Gln Asn Phe Thr Pro Arg Ile His Asp Ala Lys			
425	430	435	
acccggtaac gctgttgccg ggtgcagcct tcacctttca gggcggtatatt ttctgataac			1591
cccgtgttaa			1600

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 <212> PRT  
 <213> Pantoea citrea

<400> 8

Met	Gln	Lys	Ser	Gln	Pro	Gly	Thr	Arg	Trp	Phe	Arg	Ile	Ile	Val	Pro
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Ile	Leu	Ile	Ala	Cys	Ile	Met	Ser	Phe	Met	Asp	Arg	Val	Asn	Ile	Ser
			20					25					30		
Phe	Ala	Leu	Pro	Gly	Gly	Met	Glu	Gln	Asp	Leu	Leu	Met	Ser	Ser	Gln
		35					40					45			
Met	Ala	Gly	Val	Val	Ser	Gly	Ile	Phe	Phe	Ile	Gly	Tyr	Leu	Phe	Leu
	50					55					60				
Gln	Val	Pro	Gly	Gly	His	Ile	Ala	Val	Arg	Gly	Ser	Gly	Lys	Arg	Phe
65					70					75					80
Ile	Ala	Trp	Ser	Leu	Val	Ala	Trp	Ala	Val	Val	Ser	Val	Ala	Thr	Gly
				85					90					95	
Phe	Val	Thr	His	Gln	Tyr	Gln	Leu	Leu	Ile	Leu	Arg	Phe	Ala	Leu	Gly
			100					105					110		
Val	Ser	Glu	Gly	Gly	Met	Leu	Pro	Val	Val	Leu	Thr	Met	Val	Ser	Asn
		115					120					125			
Trp	Phe	Pro	Glu	Lys	Glu	Leu	Gly	Arg	Ala	Asn	Ala	Phe	Val	Met	Met
	130					135					140				
Phe	Ala	Pro	Leu	Gly	Gly	Met	Ile	Thr	Ala	Pro	Val	Ser	Gly	Trp	Ile
145					150					155					160
Ile	Ala	Leu	Leu	Asp	Trp	Arg	Trp	Leu	Phe	Ile	Ile	Glu	Gly	Leu	Leu
				165					170					175	
Ser	Val	Val	Val	Leu	Ala	Val	Trp	Trp	Leu	Met	Val	Ser	Asp	Arg	Pro
			180					185					190		
Glu	Asp	Ala	Arg	Trp	Leu	Pro	Ala	Ala	Glu	Arg	Glu	Tyr	Leu	Leu	Arg
	195						200					205			
Glu	Met	Ala	Arg	Asp	Lys	Ala	Glu	Arg	Ser	Lys	Leu	Pro	Pro	Ile	Ser
	210					215					220				
His	Ala	Pro	Leu	Gln	Glu	Val	Phe	His	Asn	Pro	Gly	Leu	Met	Lys	Leu
225					230					235					240
Val	Ile	Leu	Asn	Phe	Phe	Tyr	Gln	Thr	Gly	Asp	Tyr	Gly	Tyr	Thr	Leu
				245					250					255	
Trp	Leu	Pro	Thr	Ile	Ile	Lys	Asn	Leu	Thr	Gly	Ala	Ser	Ile	Gly	Asn
			260					265					270		
Val	Gly	Leu	Leu	Thr	Val	Leu	Pro	Phe	Ile	Ala	Thr	Leu	Ser	Gly	Ile
		275					280					285			
Tyr	Val	Val	Ser	Tyr	Leu	Ser	Asp	Lys	Thr	Gly	Lys	Arg	Arg	Gln	Trp
	290					295					300				
Val	Met	Ile	Ser	Leu	Phe	Cys	Phe	Ala	Ala	Cys	Leu	Leu	Ala	Ser	Val
305					310					315					320
Leu	Leu	Arg	Glu	Phe	Val	Leu	Ala	Ala	Tyr	Leu	Ala	Leu	Val	Ala	Cys
				325					330					335	
Gly	Phe	Phe	Leu	Lys	Ala	Ala	Thr	Ser	Pro	Phe	Trp	Ser	Ile	Pro	Gly
			340					345					350		
Arg	Ile	Ala	Pro	Pro	Glu	Ala	Ala	Gly	Ser	Ala	Arg	Gly	Val	Ile	Asn
		355					360					365			
Gly	Leu	Gly	Asn	Leu	Gly	Gly	Phe	Cys	Gly	Pro	Trp	Leu	Val	Gly	Leu
	370					375					380				
Met	Ile	Tyr	Leu	Tyr	Gly	Gln	Asn	Ala	Ala	Val	Val	Thr	Leu	Ala	Gly

385                      390                      395                      400  
Ser Leu Ile Ile Ala Gly Ile Ile Ala Ala Leu Leu Pro Thr Gln Cys  
                        405                      410                      415  
Asp Leu Arg Pro Ala Glu Ala Arg Gln Gln Asn Phe Thr Pro Arg Ile  
                        420                      425                      430  
His Asp Ala Lys  
                        435

Glu	Arg	Ser	Arg	Ala	Asn	Thr	Phe	Leu	Val	Leu	Gly	Asn	Pro	Val	Thr		
				140					145					150			
gtg	tta	tgg	atg	tct	att	gtt	tcc	gga	tat	ctg	atc	aat	gct	ttt	ggc		654
Val	Leu	Trp	Met	Ser	Ile	Val	Ser	Gly	Tyr	Leu	Ile	Asn	Ala	Phe	Gly		
			155					160					165				
tgg	cgg	gaa	atg	ttt	att	ttc	gag	ggg	gtg	cct	gcc	tta	atc	tgg	gcc		702
Trp	Arg	Glu	Met	Phe	Ile	Phe	Glu	Gly	Val	Pro	Ala	Leu	Ile	Trp	Ala		
			170					175					180				
atc	ttc	tgg	tgg	ttt	att	gtc	cgg	gac	aaa	ccg	gag	cag	gtg	agc	tgg		750
Ile	Phe	Trp	Trp	Phe	Ile	Val	Arg	Asp	Lys	Pro	Glu	Gln	Val	Ser	Trp		
	185					190					195						
ctg	aca	gaa	aca	gaa	aag	cag	caa	ctg	gcc	agt	gca	atg	gct	gaa	gag		798
Leu	Thr	Glu	Thr	Glu	Lys	Gln	Gln	Leu	Ala	Ser	Ala	Met	Ala	Glu	Glu		
200					205					210					215		
cag	cag	gca	ata	cca	ccg	atg	cgc	aat	gtg	ccg	cag	gcc	ctg	cgt	tcc		846
Gln	Gln	Ala	Ile	Pro	Pro	Met	Arg	Asn	Val	Pro	Gln	Ala	Leu	Arg	Ser		
				220					225					230			
cgc	aat	gtg	gtg	gta	ctg	tgc	ctg	tta	cac	gct	ctg	tgg	agc	atc	gga		894
Arg	Asn	Val	Val	Val	Leu	Cys	Leu	Leu	His	Ala	Leu	Trp	Ser	Ile	Gly		
			235					240					245				
gtg	tat	ggg	ttt	atg	atg	tgg	atg	cca	tgc	ata	ctg	cgt	agc	gct	gca		942
Val	Tyr	Gly	Phe	Met	Met	Trp	Met	Pro	Ser	Ile	Leu	Arg	Ser	Ala	Ala		
		250					255					260					
tca	atg	gac	att	gtc	cgg	gta	ggc	tgg	ctg	gcc	gca	gtt	ccg	tat	ctg		990
Ser	Met	Asp	Ile	Val	Arg	Val	Gly	Trp	Leu	Ala	Ala	Val	Pro	Tyr	Leu		
		265				270					275						
gcc	gcg	att	att	act	atg	ctg	gtg	att	tca	tgg	ctg	tca	gat	aaa	acc		1038
Ala	Ala	Ile	Ile	Thr	Met	Leu	Val	Ile	Ser	Trp	Leu	Ser	Asp	Lys	Thr		
280					285					290					295		
ggg	ctg	cgt	cgg	ctt	ttt	atc	tgg	cca	tta	ttg	ctg	att	gcg	tca	gtt		1086
Gly	Leu	Arg	Arg	Leu	Phe	Ile	Trp	Pro	Leu	Leu	Leu	Ile	Ala	Ser	Val		
				300					305					310			
act	ttt	ttt	ggg	tcc	tgg	tta	ctt	ggg	agc	tac	tca	ttc	tgg	ttt	tcc		1134
Thr	Phe	Phe	Gly	Ser	Trp	Leu	Leu	Gly	Ser	Tyr	Ser	Phe	Trp	Phe	Ser		
			315					320					325				
tat	ggc	ttg	ctg	gta	ctg	gct	gct	gct	tgt	atg	tat	gcc	ccg	tat	gga		1182
Tyr	Gly	Leu	Leu	Val	Leu	Ala	Ala	Ala	Cys	Met	Tyr	Ala	Pro	Tyr	Gly		
		330				335						340					
ccg	ttt	ttt	gcg	ttg	att	cct	gaa	ttg	ctg	cca	aaa	aat	gtg	gcg	ggg		1230
Pro	Phe	Phe	Ala	Leu	Ile	Pro	Glu	Leu	Leu	Pro	Lys	Asn	Val	Ala	Gly		
		345				350					355						
att	tct	atc	ggg	tta	att	aac	tgt	tgc	ggg	gcg	ctg	gga	gct	ttt	gcc		1278
Ile	Ser	Ile	Gly	Leu	Ile	Asn	Cys	Cys	Gly	Ala	Leu	Gly	Ala	Phe	Ala		



360	365	370	375	
gga gcc tgg ctg gtg ggc tat ctt aat ggt ctg acc ggt ggt ccg ggg				1326
Gly Ala Trp Leu Val Gly Tyr Leu Asn Gly Leu Thr Gly Gly Pro Gly				
	380	385	390	
gct tct tac act ttt atg gcc att gca ttg ctg gtt tct gta ggg ttg				1374
Ala Ser Tyr Thr Phe Met Ala Ile Ala Leu Leu Val Ser Val Gly Leu				
	395	400	405	
gtg ttt ttc ctg aaa gtc cct tca ggg aat ttg gtc act cgt cgg ttg				1422
Val Phe Phe Leu Lys Val Pro Ser Gly Asn Leu Val Thr Arg Arg Leu				
	410	415	420	
ctg aaa ggt gat gca aag taaaaggaat agcgatgaaa cggaacagga				1470
Leu Lys Gly Asp Ala Lys				
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tgtctttgca ggatattgcg gacctcgccg				1500
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Pro Val Ile Phe Ile Thr Tyr Ser Leu Ala Tyr Leu Asp Arg Ala Asn				
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Tyr Gly Phe Ala Ala Ala Ser Gly Ile Glu Ala Asp Leu Gly Ile Ser				
	35 40 45			
Arg Gly Thr Ser Ser Leu Ile Gly Ala Leu Phe Phe Leu Gly Tyr Phe				
	50 55 60			
Ile Phe Gln Val Pro Gly Ala Ile Tyr Ala Val Lys Arg Ser Val Arg				
	65 70 75 80			
Lys Leu Val Phe Thr Ser Leu Leu Leu Trp Gly Phe Cys Ala Ala Ala				
	85 90 95			
Thr Gly Leu Ile Ser Asn Ile Pro Ala Leu Met Val Ile Arg Phe Val				
	100 105 110			
Leu Gly Val Val Glu Ala Ala Val Met Pro Ala Met Leu Ile Tyr Ile				
	115 120 125			
Ser Asn Trp Phe Thr Arg Gln Glu Arg Ser Arg Ala Asn Thr Phe Leu				
	130 135 140			
Val Leu Gly Asn Pro Val Thr Val Leu Trp Met Ser Ile Val Ser Gly				
	145 150 155 160			
Tyr Leu Ile Asn Ala Phe Gly Trp Arg Glu Met Phe Ile Phe Glu Gly				
	165 170 175			
Val Pro Ala Leu Ile Trp Ala Ile Phe Trp Trp Phe Ile Val Arg Asp				
	180 185 190			
Lys Pro Glu Gln Val Ser Trp Leu Thr Glu Thr Glu Lys Gln Gln Leu				
	195 200 205			
Ala Ser Ala Met Ala Glu Glu Gln Gln Ala Ile Pro Pro Met Arg Asn				
	210 215 220			
Val Pro Gln Ala Leu Arg Ser Arg Asn Val Val Val Leu Cys Leu Leu				
	225 230 235 240			
His Ala Leu Trp Ser Ile Gly Val Tyr Gly Phe Met Met Trp Met Pro				



80	85	90	
tgg gcg gtc atc tcc gtg ctg acg ggg tta att acc aat cag tac cag			399
Trp Ala Val Ile Ser Val Leu Thr Gly Leu Ile Thr Asn Gln Tyr Gln			
95	100	105	110
ctg ctg gcc ctg cgc ttc tta ctg ggc gtg gcg gaa ggc ggt atg ctg			447
Leu Leu Ala Leu Arg Phe Leu Leu Gly Val Ala Glu Gly Gly Met Leu			
	115	120	125
ccg gtc gtt ctc acg atg atc agt aac tgg ttc ccc gac gct gaa cgc			495
Pro Val Val Leu Thr Met Ile Ser Asn Trp Phe Pro Asp Ala Glu Arg			
	130	135	140
ggc cgc gcc aac gcg att gtc att atg ttt gtg ccg att gcc ggg att			543
Gly Arg Ala Asn Ala Ile Val Ile Met Phe Val Pro Ile Ala Gly Ile			
	145	150	155
atc acc gcc cca ctc tca ggc tgg att atc acg gtt ctc gac tgg cgc			591
Ile Thr Ala Pro Leu Ser Gly Trp Ile Ile Thr Val Leu Asp Trp Arg			
	160	165	170
tgg ctg ttt att atc gaa ggt ttg ctc tcg ctg gtt gtt ctg gtt ctg			639
Trp Leu Phe Ile Ile Glu Gly Leu Leu Ser Leu Val Val Leu Val Leu			
175	180	185	190
tgg gca tac acc atc tat gac cgt ccg cag gaa gcg cgc tgg att tcc			687
Trp Ala Tyr Thr Ile Tyr Asp Arg Pro Gln Glu Ala Arg Trp Ile Ser			
	195	200	205
gaa gca gag aag cgc tat ctg gtc gag acg ctg gcc gcg gag caa aaa			735
Glu Ala Glu Lys Arg Tyr Leu Val Glu Thr Leu Ala Ala Glu Gln Lys			
	210	215	220
gcc att gcc ggc acc gag gtg aaa aac gcc tct ctg agc gcc gtt ctc			783
Ala Ile Ala Gly Thr Glu Val Lys Asn Ala Ser Leu Ser Ala Val Leu			
	225	230	235
tcc gac aaa acc atg tgg cag ctt atc gcc ctg aac ttc ttc tac cag			831
Ser Asp Lys Thr Met Trp Gln Leu Ile Ala Leu Asn Phe Phe Tyr Gln			
	240	245	250
acc ggc att tac ggc tac acc ctg tgg cta ccc acc att ctg aaa gaa			879
Thr Gly Ile Tyr Gly Tyr Thr Leu Trp Leu Pro Thr Ile Leu Lys Glu			
255	260	265	270
ttg acc cat agc agc atg ggg cag gtc ggc atg ctt gcc att ctg ccg			927
Leu Thr His Ser Ser Met Gly Gln Val Gly Met Leu Ala Ile Leu Pro			
	275	280	285
tac gtc ggc gcc att gct ggg atg ttc ctg ttt tcc tcc ctt tca gac			975
Tyr Val Gly Ala Ile Ala Gly Met Phe Leu Phe Ser Ser Leu Ser Asp			
	290	295	300
cga acc ggt aaa cgc aag ctg ttc gtc tgc ctg ccg ctg att ggc ttc			1023

Arg Thr Gly Lys Arg Lys Leu Phe Val Cys Leu Pro Leu Ile Gly Phe	
305 310 315	
gct ctg tgc atg ttc ctg tcg gtg gcg ctg aaa aac caa att tgg ctc	1071
Ala Leu Cys Met Phe Leu Ser Val Ala Leu Lys Asn Gln Ile Trp Leu	
320 325 330	
tcc tat gcc gcg ctg gtc ggc tgc gga ttc ttc ctg caa tcg gcg gct	1119
Ser Tyr Ala Ala Leu Val Gly Cys Gly Phe Leu Gln Ser Ala Ala	
335 340 345 350	
ggc gtg ttc tgg acc atc ccg gca cgt ctg ttc agc gcg gaa atg gcg	1167
Gly Val Phe Trp Thr Ile Pro Ala Arg Leu Phe Ser Ala Glu Met Ala	
355 360 365	
ggc ggc gcg cgc ggg gtt atc aac gcg ctt ggc aac ctc ggc gga ttt	1215
Gly Gly Ala Arg Gly Val Ile Asn Ala Leu Gly Asn Leu Gly Gly Phe	
370 375 380	
tgt ggc cct tat gcg gtc ggg gtg ctg atc acg ttg tac agc aaa gac	1263
Cys Gly Pro Tyr Ala Val Gly Val Leu Ile Thr Leu Tyr Ser Lys Asp	
385 390 395	
gct ggc gtc tat tgc ctg gcg atc tcc ctg gcg ctg gcc gcg ctg atg	1311
Ala Gly Val Tyr Cys Leu Ala Ile Ser Leu Ala Leu Ala Ala Leu Met	
400 405 410	
gcg ctg ctg ctg ccg gcg aaa tgc gat gcc ggt gct gcg ccg gta aag	1359
Ala Leu Leu Leu Pro Ala Lys Cys Asp Ala Gly Ala Ala Pro Val Lys	
415 420 425 430	
acg ata aat cca cat aaa cgc act gcg taaactcgag cccggcggcg	1406
Thr Ile Asn Pro His Lys Arg Thr Ala	
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Met Asp Arg Val Asn Ile Ala Phe Ala Met Pro Gly Gly Met Asp Ala	
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Asp Leu Gly Ile Ser Ala Thr Met Ala Gly Leu Ala Gly Gly Ile Phe	
50 55 60	
Phe Ile Gly Tyr Leu Phe Leu Gln Val Pro Gly Gly Lys Ile Ala Val	
65 70 75 80	
His Gly Ser Gly Lys Lys Phe Ile Gly Trp Ser Leu Val Ala Trp Ala	

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Val	Leu	Thr	Met	Ile	Ser	Asn	Trp	Phe	Pro	Asp	Ala	Glu	Arg	Gly	Arg		
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Ala	Asn	Ala	Ile	Val	Ile	Met	Phe	Val	Pro	Ile	Ala	Gly	Ile	Ile	Thr		
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Ala	Pro	Leu	Ser	Gly	Trp	Ile	Ile	Thr	Val	Leu	Asp	Trp	Arg	Trp	Leu		
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Phe	Ile	Ile	Glu	Gly	Leu	Leu	Ser	Leu	Val	Val	Leu	Val	Leu	Trp	Ala		
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Tyr	Thr	Ile	Tyr	Asp	Arg	Pro	Gln	Glu	Ala	Arg	Trp	Ile	Ser	Glu	Ala		
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Lys	Thr	Met	Trp	Gln	Leu	Ile	Ala	Leu	Asn	Phe	Phe	Tyr	Gln	Thr	Gly		
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Ile	Tyr	Gly	Tyr	Thr	Leu	Trp	Leu	Pro	Thr	Ile	Leu	Lys	Glu	Leu	Thr		
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His	Ser	Ser	Met	Gly	Gln	Val	Gly	Met	Leu	Ala	Ile	Leu	Pro	Tyr	Val		
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Gly	Ala	Ile	Ala	Gly	Met	Phe	Leu	Phe	Ser	Ser	Leu	Ser	Asp	Arg	Thr		
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Gly	Lys	Arg	Lys	Leu	Phe	Val	Cys	Leu	Pro	Leu	Ile	Gly	Phe	Ala	Leu		
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Cys	Met	Phe	Leu	Ser	Val	Ala	Leu	Lys	Asn	Gln	Ile	Trp	Leu	Ser	Tyr		
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Ala	Ala	Leu	Val	Gly	Cys	Gly	Phe	Phe	Leu	Gln	Ser	Ala	Ala	Gly	Val		
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Phe	Trp	Thr	Ile	Pro	Ala	Arg	Leu	Phe	Ser	Ala	Glu	Met	Ala	Gly	Gly		
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385				390					395						400		
Val	Tyr	Cys	Leu	Ala	Ile	Ser	Leu	Ala	Leu	Ala	Ala	Leu	Met	Ala	Leu		
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Leu	Leu	Pro	Ala	Lys	Cys	Asp	Ala	Gly	Ala	Ala	Pro	Val	Lys	Thr	Ile		
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atccaccccg ctccctccaa agctttatga ggctatagga tattgatatg gtatcgataa      180
cactcctgtc aagaggcggt tttcacgcca ggcgggaggg caaaatagga ctggacaatt      240
ccttcaagcg ggatatgtta tcgataacaa atcatcttcc ggaggagagc c atg agc      297
                                         Met Ser
                                         1
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aag atc gat gtg ttg cag gtc ggt ccc tac cct gca tgg gac gag gag      345
Lys Ile Asp Val Leu Gln Val Gly Pro Tyr Pro Ala Trp Asp Glu Glu
                    5                      10                      15
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cgc ctg aac gcg acc ttc acg atg cac cgc tat ttc gag gcg gcc gac      393
Arg Leu Asn Ala Thr Phe Thr Met His Arg Tyr Phe Glu Ala Ala Asp
                    20                      25                      30
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aag gcg gcg ttt ctg gcc gag cac ggc ggc acg atc cgc ggc atc gcc      441
Lys Ala Ala Phe Leu Ala Glu His Gly Gly Thr Ile Arg Gly Ile Ala
                    35                      40                      45                      50
```

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acg cgc ggc gag ctt ggt gcc aac cgg gcg atg atc gag gcg ctg ccg      489
Thr Arg Gly Glu Leu Gly Ala Asn Arg Ala Met Ile Glu Ala Leu Pro
                    55                      60                      65
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aag ctg gaa gtg atc tcg gtc tac ggc gtc ggc ttc gat gcg gtg gac      537
Lys Leu Glu Val Ile Ser Val Tyr Gly Val Gly Phe Asp Ala Val Asp
                    70                      75                      80
```

```
ctt tcg gcg gcc cgc gag cgc ggc atc cgc gtc acc aac acg ccc gac      585
Leu Ser Ala Ala Arg Glu Arg Gly Ile Arg Val Thr Asn Thr Pro Asp
                    85                      90                      95
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gtg ctc acc aag gac gtg gcc gat ctc ggc atc gcc atg atg ctg gcg      633
Val Leu Thr Lys Asp Val Ala Asp Leu Gly Ile Ala Met Met Leu Ala
                    100                      105                      110
```

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cag gcg cgc ggc gtc atc ggc gga gag gcc tgg gtg aag agc ggc gat      681
Gln Ala Arg Gly Val Ile Gly Gly Glu Ala Trp Val Lys Ser Gly Asp
                    115                      120                      125                      130
```

```
tgg gca agc aag ggt ctc tat ccg ctg aag cgc cgc gta cat ggc atg      729
Trp Ala Ser Lys Gly Leu Tyr Pro Leu Lys Arg Arg Val His Gly Met
                    135                      140                      145
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cgc gcc ggg gtg ctc ggc ctc ggc cgc atc ggc tac gag gtg gcc aag      777
Arg Ala Gly Val Leu Gly Leu Gly Arg Ile Gly Tyr Glu Val Ala Lys
                    150                      155                      160
```

```
cgc ctt gcc ggc ttc gac atg gac atc gcc tac agc gac acc ggc ccg      825
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Arg	Leu	Ala	Gly	Phe	Asp	Met	Asp	Ile	Ala	Tyr	Ser	Asp	Thr	Gly	Pro		
	165						170					175					
aag	gat	ttc	gcc	agg	gac	tgg	acc	ttc	gtc	gcc	gat	ccg	gcg	gag	ctg		873
Lys	Asp	Phe	Ala	Arg	Asp	Trp	Thr	Phe	Val	Ala	Asp	Pro	Ala	Glu	Leu		
	180					185					190						
gcc	gcc	cgc	tcc	gac	ttc	ctc	ttc	gtc	acg	ctc	gcc	gcc	tcc	gcc	gag		921
Ala	Ala	Arg	Ser	Asp	Phe	Leu	Phe	Val	Thr	Leu	Ala	Ala	Ser	Ala	Glu		
195					200					205					210		
acg	cgc	cac	atc	gtc	ggc	cgc	aag	gtc	atc	gag	gcg	ctc	ggc	cct	gag		969
Thr	Arg	His	Ile	Val	Gly	Arg	Lys	Val	Ile	Glu	Ala	Leu	Gly	Pro	Glu		
			215					220						225			
ggc	atg	ctg	atc	aac	atc	tcg	cgc	gct	tcc	aac	atc	gat	gaa	agc	gcc		1017
Gly	Met	Leu	Ile	Asn	Ile	Ser	Arg	Ala	Ser	Asn	Ile	Asp	Glu	Ser	Ala		
			230					235					240				
ctt	ctc	gac	gcg	ctg	gag	acg	aag	gcg	ctc	ggc	tcg	gcc	gcg	ctc	gac		1065
Leu	Leu	Asp	Ala	Leu	Glu	Thr	Lys	Ala	Leu	Gly	Ser	Ala	Ala	Leu	Asp		
		245					250					255					
gtc	ttc	gag	ggc	gag	ccg	aac	ctc	aat	ccg	cgt	ttc	ctt	gcc	ctc	gac		1113
Val	Phe	Glu	Gly	Glu	Pro	Asn	Leu	Asn	Pro	Arg	Phe	Leu	Ala	Leu	Asp		
	260					265				270							
aac	gtc	ctc	ttg	cag	ccg	cac	atg	gcc	tcc	ggc	acg	atc	gag	acc	cgc		1161
Asn	Val	Leu	Leu	Gln	Pro	His	Met	Ala	Ser	Gly	Thr	Ile	Glu	Thr	Arg		
275					280					285					290		
aag	gcc	atg	ggc	cag	ctc	gtc	ttc	gac	aac	ctg	tcg	gcc	cat	ttc	gac		1209
Lys	Ala	Met	Gly	Gln	Leu	Val	Phe	Asp	Asn	Leu	Ser	Ala	His	Phe	Asp		
				295					300					305			
ggc	cgg	ccg	ctg	ccg	acc	ccg	gtt	ctg	taaggagaga				ggtcc	atg	aag	gcg	1260
Gly	Arg	Pro	Leu	Pro	Thr	Pro	Val	Leu						Met	Lys	Ala	
			310					315									
atc	gtc	atc	cat	cag	gcc	aag	gac	ctg	cgc	gtc	gag	gac	agc	gcc	gtc		1308
Ile	Val	Ile	His	Gln	Ala	Lys	Asp	Leu	Arg	Val	Glu	Asp	Ser	Ala	Val		
	320					325					330						
gag	gcg	ccc	ggc	ccc	ggc	gag	gtg	gag	atc	cgc	ctt	gcc	gcc	ggc	ggc		1356
Glu	Ala	Pro	Gly	Pro	Gly	Glu	Val	Glu	Ile	Arg	Leu	Ala	Ala	Gly	Gly		
335					340					345					350		
atc	tgc	ggc	tcg	gac	ctg	cac	tac	tac	aac	cac	ggc	ggc	ttc	ggc	acg		1404
Ile	Cys	Gly	Ser	Asp	Leu	His	Tyr	Tyr	Asn	His	Gly	Gly	Phe	Gly	Thr		
				355					360					365			
gtg	cgc	ctc	aag	gag	ccg	atg	atc	ctc	ggc	cat	gag	gtt	tcc	ggc	cac		1452
Val	Arg	Leu	Lys	Glu	Pro	Met	Ile	Leu	Gly	His	Glu	Val	Ser	Gly	His		
			370					375						380			
gtc	gcg	gcg	ctc	ggc	gaa	ggc	gtc	tcc	ggc	ctt	gcc	atc	ggc	gac	ctc		1500

Val	Ala	Ala	Leu	Gly	Glu	Gly	Val	Ser	Gly	Leu	Ala	Ile	Gly	Asp	Leu	
	385						390					395				
gtc	gcc	gtc	tcg	ccc	tcg	cgg	ccc	tgc	ggg	gcg	tgc	gac	tat	tgc	ctc	1548
Val	Ala	Val	Ser	Pro	Ser	Arg	Pro	Cys	Gly	Ala	Cys	Asp	Tyr	Cys	Leu	
	400					405					410					
aag	ggc	ttg	gcg	aac	cat	tgc	ttc	aac	atg	cgc	ttc	tac	ggc	tcg	gcc	1596
Lys	Gly	Leu	Ala	Asn	His	Cys	Phe	Asn	Met	Arg	Phe	Tyr	Gly	Ser	Ala	
415					420					425					430	
atg	ccc	ttc	ccg	cac	atc	cag	ggc	gcg	ttc	cgc	gag	cgg	ctg	gtc	gcc	1644
Met	Pro	Phe	Pro	His	Ile	Gln	Gly	Ala	Phe	Arg	Glu	Arg	Leu	Val	Ala	
				435					440					445		
aag	gcc	agc	cag	tgc	gtg	aag	gct	gag	ggc	ctt	tcg	gca	ggg	gaa	gcc	1692
Lys	Ala	Ser	Gln	Cys	Val	Lys	Ala	Glu	Gly	Leu	Ser	Ala	Gly	Glu	Ala	
			450					455					460			
gcg	atg	gcc	gag	ccg	ctc	tcc	gtc	acg	ctt	cac	gcc	acg	cgc	cgg	gcc	1740
Ala	Met	Ala	Glu	Pro	Leu	Ser	Val	Thr	Leu	His	Ala	Thr	Arg	Arg	Ala	
	465						470					475				
ggc	gaa	atg	ctg	ggc	aag	cgc	gtg	ctc	gtc	acc	ggc	tgc	ggg	ccg	atc	1788
Gly	Glu	Met	Leu	Gly	Lys	Arg	Val	Leu	Val	Thr	Gly	Cys	Gly	Pro	Ile	
	480					485					490					
ggc	acc	ctg	tcg	atc	ctc	gcc	gcc	cgg	cgc	gcc	ggc	gcg	gcg	gag	atc	1836
Gly	Thr	Leu	Ser	Ile	Leu	Ala	Ala	Arg	Arg	Ala	Gly	Ala	Ala	Glu	Ile	
495					500					505					510	
gtc	gcc	gct	gac	ctt	tcc	gag	cgt	gca	ctc	ggc	ttt	gcc	cgc	gcc	gtc	1884
Val	Ala	Ala	Asp	Leu	Ser	Glu	Arg	Ala	Leu	Gly	Phe	Ala	Arg	Ala	Val	
				515					520					525		
ggc	gcg	gac	cgc	acg	gtc	aac	ctg	tcg	gaa	gac	cgc	gac	ggc	ctc	gtt	1932
Gly	Ala	Asp	Arg	Thr	Val	Asn	Leu	Ser	Glu	Asp	Arg	Asp	Gly	Leu	Val	
		530						535					540			
ccg	ttc	agc	gag	aac	aag	gga	tat	ttc	gat	gtc	ctc	tac	gaa	tgc	tcg	1980
Pro	Phe	Ser	Glu	Asn	Lys	Gly	Tyr	Phe	Asp	Val	Leu	Tyr	Glu	Cys	Ser	
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ggc	gcc	cag	ccg	gcg	ctg	gtt	gcc	ggc	atc	cag	gcc	ttg	cgc	ccg	cgc	2028
Gly	Ala	Gln	Pro	Ala	Leu	Val	Ala	Gly	Ile	Gln	Ala	Leu	Arg	Pro	Arg	
	560					565					570					
ggc	gtc	atc	gtc	cag	ctc	ggc	ctc	ggc	ggc	gag	atg	agc	ctt	ccc	atg	2076
Gly	Val	Ile	Val	Gln	Leu	Gly	Leu	Gly	Gly	Glu	Met	Ser	Leu	Pro	Met	
575					580					585					590	
atg	gcg	atc	acc	gcc	aag	gaa	ctg	gac	ctg	cgc	ggc	tcc	ttc	cgc	ttc	2124
Met	Ala	Ile	Thr	Ala	Lys	Glu	Leu	Asp	Leu	Arg	Gly	Ser	Phe	Arg	Phe	
				595					600					605		
cat	gag	gaa	ttc	gcc	gtc	gcc	gtg	aag	ctg	atg	cag	ggc	ggc	ctc	atc	2172
His	Glu	Glu	Phe	Ala	Val	Ala	Val	Lys	Leu	Met	Gln	Gly	Gly	Leu	Ile	



610	615	620	
gac gtg aag ccg ctg atc acc cat act ttg ccg ctt gcc gat gcg ctt Asp Val Lys Pro Leu Ile Thr His Thr Leu Pro Leu Ala Asp Ala Leu 625 630 635			2220
cag gcc ttc gag atc gcc tcg gac aag ggg caa tcg atg aag act cag Gln Ala Phe Glu Ile Ala Ser Asp Lys Gly Gln Ser Met Lys Thr Gln 640 645 650			2268
atc gca ttc agt taaggaagag cc atg agc atc cag ctt ttc gac ctc acg Ile Ala Phe Ser Met Ser Ile Gln Leu Phe Asp Leu Thr 655 660 665			2319
ggc aag cgc gcc ctc gtc acc ggc tcc tcg cag ggt atc ggc tat gcg Gly Lys Arg Ala Leu Val Thr Gly Ser Ser Gln Gly Ile Gly Tyr Ala 670 675 680			2367
ctc gcc aag ggc ctt gcc gcc gcc ggc gcg gac atc gtc ctc aac ggc Leu Ala Lys Gly Leu Ala Ala Ala Gly Ala Asp Ile Val Leu Asn Gly 685 690 695			2415
cgc gac gcg gcc aag ctg gcg gcc gcg gcg cag gaa ctc ggc gca aag Arg Asp Ala Ala Lys Leu Ala Ala Ala Ala Gln Glu Leu Gly Ala Lys 700 705 710 715			2463
cac acg ctc gcc ttc gac gcc acc gac cat gcc gcc gtg cgc gcg gcc His Thr Leu Ala Phe Asp Ala Thr Asp His Ala Ala Val Arg Ala Ala 720 725 730			2511
atc gac gcc ttc gag gcg gag gtc ggc ccc atc gac atc ctc gtc aac Ile Asp Ala Phe Glu Ala Glu Val Gly Pro Ile Asp Ile Leu Val Asn 735 740 745			2559
aat gcc ggc atg cag cac cgc acg ccg ctg gag gat ttc ccc gcc gat Asn Ala Gly Met Gln His Arg Thr Pro Leu Glu Asp Phe Pro Ala Asp 750 755 760			2607
gcc ttc gag cgc atc ctg aag acc aac atc tcg acg gtc ttc aat gtc Ala Phe Glu Arg Ile Leu Lys Thr Asn Ile Ser Thr Val Phe Asn Val 765 770 775			2655
ggc cag gcc gtc gcg cgc cac atg atc gcg cgc ggc gcg ggc aag atc Gly Gln Ala Val Ala Arg His Met Ile Ala Arg Gly Ala Gly Lys Ile 780 785 790 795			2703
atc aac atc gcc agc gtg cag acc gcg ctc gcc cgc ccc ggc atc gcg Ile Asn Ile Ala Ser Val Gln Thr Ala Leu Ala Arg Pro Gly Ile Ala 800 805 810			2751
ccc tat acc gcc acc aag ggc gcc gtc ggc aac ctc acc aag ggc atg Pro Tyr Thr Ala Thr Lys Gly Ala Val Gly Asn Leu Thr Lys Gly Met 815 820 825			2799
gcg acc gac tgg gcg aaa tac ggc ctg caa tgc aac gcc atc gcg ccg			2847

Ala Thr Asp Trp Ala Lys Tyr Gly Leu Gln Cys Asn Ala Ile Ala Pro  
830 835 840

ggc tat ttc gac acg ccg ctc aat gcc gcg ctg gtc gcc gat ccg gcc 2895  
Gly Tyr Phe Asp Thr Pro Leu Asn Ala Ala Leu Val Ala Asp Pro Ala  
845 850 855

ttt tcc gcc tgg ctg gaa aag cgc acg ccg gcc ggc cgc tgg ggc aag 2943  
Phe Ser Ala Trp Leu Glu Lys Arg Thr Pro Ala Gly Arg Trp Gly Lys  
860 865 870 875

gtg gag gag ctg atc ggc gcc tgc atc ttt ctt tcc tcc gac gct tcc 2991  
Val Glu Glu Leu Ile Gly Ala Cys Ile Phe Leu Ser Ser Asp Ala Ser  
880 885 890

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Ser Phe Val Asn Gly His Thr Leu Tyr Val Asp Gly Gly Ile Thr Ala  
895 900 905

tcg ctc tgaggacaac aggcgcacatcg tcctgatggg cgtcgccggc tgcggcaagt 3095  
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Ala Asp Lys Ala Ala Phe Leu Ala Glu His Gly Gly Thr Ile Arg Gly  
35 40 45  
Ile Ala Thr Arg Gly Glu Leu Gly Ala Asn Arg Ala Met Ile Glu Ala  
50 55 60  
Leu Pro Lys Leu Glu Val Ile Ser Val Tyr Gly Val Gly Phe Asp Ala  
65 70 75 80  
Val Asp Leu Ser Ala Ala Arg Glu Arg Gly Ile Arg Val Thr Asn Thr  
85 90 95  
Pro Asp Val Leu Thr Lys Asp Val Ala Asp Leu Gly Ile Ala Met Met  
100 105 110  
Leu Ala Gln Ala Arg Gly Val Ile Gly Gly Glu Ala Trp Val Lys Ser  
115 120 125  
Gly Asp Trp Ala Ser Lys Gly Leu Tyr Pro Leu Lys Arg Arg Val His  
130 135 140  
Gly Met Arg Ala Gly Val Leu Gly Leu Gly Arg Ile Gly Tyr Glu Val  
145 150 155 160  
Ala Lys Arg Leu Ala Gly Phe Asp Met Asp Ile Ala Tyr Ser Asp Thr  
165 170 175  
Gly Pro Lys Asp Phe Ala Arg Asp Trp Thr Phe Val Ala Asp Pro Ala  
180 185 190

Glu Leu Ala Ala Arg Ser Asp Phe Leu Phe Val Thr Leu Ala Ala Ser  
 195 200 205  
 Ala Glu Thr Arg His Ile Val Gly Arg Lys Val Ile Glu Ala Leu Gly  
 210 215 220  
 Pro Glu Gly Met Leu Ile Asn Ile Ser Arg Ala Ser Asn Ile Asp Glu  
 225 230 235 240  
 Ser Ala Leu Leu Asp Ala Leu Glu Thr Lys Ala Leu Gly Ser Ala Ala  
 245 250 255  
 Leu Asp Val Phe Glu Gly Glu Pro Asn Leu Asn Pro Arg Phe Leu Ala  
 260 265 270  
 Leu Asp Asn Val Leu Leu Gln Pro His Met Ala Ser Gly Thr Ile Glu  
 275 280 285  
 Thr Arg Lys Ala Met Gly Gln Leu Val Phe Asp Asn Leu Ser Ala His  
 290 295 300  
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 Ala Gly Gly Ile Cys Gly Ser Asp Leu His Tyr Tyr Asn His Gly Gly  
 35 40 45  
 Phe Gly Thr Val Arg Leu Lys Glu Pro Met Ile Leu Gly His Glu Val

50 55 60  
 Ser Gly His Val Ala Ala Leu Gly Glu Gly Val Ser Gly Leu Ala Ile  
 65 70 75 80  
 Gly Asp Leu Val Ala Val Ser Pro Ser Arg Pro Cys Gly Ala Cys Asp  
 85 90 95  
 Tyr Cys Leu Lys Gly Leu Ala Asn His Cys Phe Asn Met Arg Phe Tyr  
 100 105 110  
 Gly Ser Ala Met Pro Phe Pro His Ile Gln Gly Ala Phe Arg Glu Arg  
 115 120 125  
 Leu Val Ala Lys Ala Ser Gln Cys Val Lys Ala Glu Gly Leu Ser Ala  
 130 135 140  
 Gly Glu Ala Ala Met Ala Glu Pro Leu Ser Val Thr Leu His Ala Thr  
 145 150 155 160  
 Arg Arg Ala Gly Glu Met Leu Gly Lys Arg Val Leu Val Thr Gly Cys  
 165 170 175  
 Gly Pro Ile Gly Thr Leu Ser Ile Leu Ala Ala Arg Arg Ala Gly Ala  
 180 185 190  
 Ala Glu Ile Val Ala Ala Asp Leu Ser Glu Arg Ala Leu Gly Phe Ala  
 195 200 205  
 Arg Ala Val Gly Ala Asp Arg Thr Val Asn Leu Ser Glu Asp Arg Asp  
 210 215 220  
 Gly Leu Val Pro Phe Ser Glu Asn Lys Gly Tyr Phe Asp Val Leu Tyr

225					230					235				240	
Glu	Cys	Ser	Gly	Ala	Gln	Pro	Ala	Leu	Val	Ala	Gly	Ile	Gln	Ala	Leu
				245					250					255	
Arg	Pro	Arg	Gly	Val	Ile	Val	Gln	Leu	Gly	Leu	Gly	Gly	Glu	Met	Ser
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Leu	Pro	Met	Met	Ala	Ile	Thr	Ala	Lys	Glu	Leu	Asp	Leu	Arg	Gly	Ser
		275					280					285			
Phe	Arg	Phe	His	Glu	Glu	Phe	Ala	Val	Ala	Val	Lys	Leu	Met	Gln	Gly
		290				295					300				
Gly	Leu	Ile	Asp	Val	Lys	Pro	Leu	Ile	Thr	His	Thr	Leu	Pro	Leu	Ala
305				310					315					320	
Asp	Ala	Leu	Gln	Ala	Phe	Glu	Ile	Ala	Ser	Asp	Lys	Gly	Gln	Ser	Met
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Thr	Asp	His	Ala	Ala	Val	Arg	Ala	Ala	Ile	Asp	Ala	Phe	Glu	Ala	Glu
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Val	Gly	Pro	Ile	Asp	Ile	Leu	Val	Asn	Asn	Ala	Gly	Met	Gln	His	Arg
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Gly	Leu	Gln	Cys	Asn	Ala	Ile	Ala	Pro	Gly	Tyr	Phe	Asp	Thr	Pro	Leu
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Asn	Ala	Ala	Leu	Val	Ala	Asp	Pro	Ala	Phe	Ser	Ala	Trp	Leu	Glu	Lys
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Arg	Thr	Pro	Ala	Gly	Arg	Trp	Gly	Lys	Val	Glu	Glu	Leu	Ile	Gly	Ala
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Cys	Ile	Phe	Leu	Ser	Ser	Asp	Ala	Ser	Ser	Phe	Val	Asn	Gly	His	Thr
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